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Introduction

Nine years after Operations Desert Shield and Desert Storm (the Gulf War) ended in June 1991, uncertainty and questions remain about illnesses reported in a substantial percentage of the 697,000 service members who were deployed. Even though it was a short conflict with very few battle casualties, the events that occurred during the Gulf War and the experiences of the ensuing years have made clear many potentially instructive aspects of the deployment and its hazards. Since the Gulf War, several other large deployments have also occurred, including deployments to Haiti and Somalia. Major deployments to Bosnia, Southwest Asia, and, most recently, Kosovo, are ongoing as this report is written. This report draws on lessons learned from some of these deployments to consider strategies for improved preventive measures to protect the health of troops in future deployments.

By the spring of 1996, at least six different expert panels had reviewed or were in the process of reviewing various aspects of the illnesses reported by Gulf War veterans or programs developed in response to the illnesses (National Institutes of Health Technology Assessment Workshop Panel, 1994; U.S. Department of Defense, 1994b; Institute of Medicine, 1996a; Institute of Medicine, 1996c; Presidential Advisory Committee on Gulf War Veterans' Illnesses, 1996b; U.S. Department of Veterans Affairs, 1996). Deputy Secretary of Defense John White met with leadership of the National Research Council and the Institute of Medicine to explore the idea of an independent, proactive effort to learn from lessons of the Gulf War and to develop a strategy to better protect the health of troops in future deployments.

The study presented in this report developed from those discussions. The U.S. Department of Defense (DoD) (acronyms used in this report are found in front of the Table of Contents) sought an independent, external, and unbiased evaluation of its efforts regarding the protection of U.S. forces in four areas: (1)

assessment of health risks during deployments in hostile environments, (2) technologies and methods for detection and tracking of exposures to a subset of harmful agents, (3) physical protection and decontamination, and (4) medical protection, health consequences and treatment, and medical record keeping. Studies that have addressed topics 1, 2, and 3 have been carried out concurrently by the Commission on Life Sciences and the Commission on Engineering and Technical Systems of the National Research Council, and have resulted in three companion reports (National Research Council, 1999a,b,c).

The study presented here, carried out with staff support from the Medical Follow-up Agency of the Institute of Medicine, addresses the topics of medical protection, health consequences and treatment, and medical record keeping. The charge to the study team was included in the contract between the Department of Defense and the National Academies and became central to the Statement of Task:

> The [*overall*] project will advise DOD on a long-term strategy for protecting the health of our nation's military personnel when deployed to unfamiliar environments. Drawing on the lessons of previous conflicts, it will advise the DOD with regard to a strategy for managing the health and exposure issues faced during deployments; these include infectious agents, vaccines, drug interactions, and stress. It also will include adverse reactions to chemical or biological warfare agents and other substances. The project will address the problem of limited and variable data in the past, and in the development of a prospective strategy for improved handling of health and exposure issues in future deployments.
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> This study concerns medical protection, health consequences and treatment, and medical record keeping. Specific issues to be addressed include:
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> Prevention of adverse health outcomes that could result from exposures to threats and risks including chemical warfare and biological warfare, infectious disease, psychological stress, heat and cold injuries, unintentional injuries;
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> Requirements for compliance with active duty retention standards;
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> Pre-deployment screening, physical evaluation, risk education for troops and medical personnel;
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> Vaccine and other prophylactic agents;
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> Improvements in risk communication with military personnel in order to minimize stress casualties among exposed, or potentially exposed personnel;
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> Improvements in the reintegration of all troops to the home environment;
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> Treatment of the health consequences of prevention failures, including battle injuries, disease and non-battle injury (DNBI), acute management, and long-term follow-up;
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> Surveillance for short- and long-term outcomes, to include adverse reproductive outcomes; and
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> Improvement in keeping medical records, perhaps using entirely new technology, in documenting exposures, treatment, tracking of individuals through the

medical evacuation system, and health/administrative outcomes. (Statement of Task, Appendix B)

EMPHASIS AND IMPLICIT ASSUMPTIONS

The charge to the study team is very broad. Its different specific components roughly include all of military preventive medicine. With this broad scope, the study team members chose to emphasize areas in which they saw the greatest needs or needs of a systemic nature and to treat other areas with a necessarily broader brush. A brief review of many of the risks to the health of deployed forces is found in Chapter 2. Since an important motivating force for the study was the health concerns of veterans following the Gulf War, the study team chose to focus on the major challenges for prevention and data needs pointed out by the health problems widely reported by deployed forces after the Gulf War and the efforts to better understand them.

What were the lessons of the Gulf War? Briefly, one of the lessons was that even in the absence of widespread acute casualties from battle, war takes its toll on human health and well-being long after the shooting or bombing stops. Although military preventive medicine programs have developed reasonably effective countermeasures against many of the discrete disease and non-battle injury hazards of deployment, they have not yet systematically addressed the medically unexplained symptoms seen not only after the Gulf War but also after major wars dating back at least to the Civil War. Medically unexplained symptoms are described and discussed in Chapter 3.

The health problems reported by veterans after the Gulf War also brought out two other major and interrelated needs for improvements in preventive care for deployed forces. One is for a health surveillance system with documentation so that health events in the field are noted and responded to. This is discussed in Chapter 4. Closely allied is the need for an automated medical record that can provide information about a service member's health events over his or her service career and into civilian life after military service. Chapter 5 discusses DoD plans for electronic medical record keeping.

Although the study team considered the service member's life cycle of recruitment, predeployment, deployment, and postdeployment to include separation from the service, the postdeployment period appeared to be a time when, in particular, additional effort could be crucial in attending to the health of the deployed forces. The report discusses needs and opportunities for improved surveillance, special focused health care, and assistance with reintegration into the home environment during this time.

Two other major issues emerged as the study group went about its work. One serious challenge to the protection of deployed U.S. forces, discussed in Chapter 8, is that of providing the National Guard and Reserve components with the preparation for deployment and health surveillance afforded the active duty component. As active-duty forces have been reduced, the reserves play an increasingly important role in military deployments. Yet, their lack of access to

the military health care system while they are inactive places serious limitations on the routine health care that they receive and the ability to monitor their health status over both the short and long term after a deployment. This problem for the reserves highlights a challenge for many active-duty service members after they separate from military service. To the extent that they receive their health care in the civilian sector and not through the U.S. Department of Veterans Affairs (VA), the capture of any data on their health care is problematic, as is the concept of a true lifetime medical record promised by the President in 1997 (White House, Office of the Press Secretary, 1997).

A second issue that the study team came to recognize as a serious concern was that although there have been encouraging changes in DoD policy with new emphasis on what is termed Force Health Protection, these changes have not yet been reflected in the structural and cultural changes that will be needed within the services (the Army, Navy, and Air Force; the Marines are a part of the Navy, and the Coast Guard is part of the Navy only in wartime) and DoD so that they may carry out the laudable new policies. Effective application of an improved health surveillance system (Chapter 4) and integrated computer-based patient record (Chapter 5) will require concerted leadership and coordination to prevent the inexorable tendency toward "stovepiping"—that is, the development or continuation of an array of independent tasks or service-specific systems that cannot meet the current needs for information exchange and follow-up.

High-level leadership and coordination are also needed to effect changes in the way in which medically unexplained symptoms are addressed in military populations. Although the problem is not unique to the military, it is regularly seen in populations who have participated in major deployments and will likely be observed after future deployments. Efforts to intervene to try to prevent or ameliorate medically unexplained symptoms are needed, as are careful evaluations of these efforts and a related research program. The needs in this area are further described in Chapter 6.

Need for additional high-level leadership and coordination for military public health and preventive medicine run counter to the current momentum within DoD. The medical structure of DoD is focused on the delivery of health care and the operation of the Tri-Care program (the military health maintenance organization). The costs of the health care delivery system are enormous, and management of the health care delivery system has come to dominate DoD's medical leadership. High-quality health care is crucial to recruitment and retention of good service members, but in the current environment, the practice of military preventive medicine and military medicine appears to compete very poorly for personnel, funding, and leadership resources.

RELATED EFFORTS

As the study took place, several relevant efforts were under way at DoD and VA. In response to recommendations from the Presidential Advisory Committee

on Gulf War Veterans' Illnesses, an interagency task force with representatives from DoD, VA, and the U.S. Department of Health and Human Services prepared a plan to protect the health of service members and their families. Released in November 1998, the plan, entitled *A National Obligation: Planning for Health Preparedness for and Readjustment of the Military, Veterans, and Their Families after Future Deployments*, articulated many goals that the study team found laudable (National Science and Technology Council, 1998). The document is referred to several times throughout the report, frequently with the hope that the strategies described to meet the goals stated in the plan are actually implemented.

As the present study was under way, the U.S. Congress passed legislation that required the VA to contract with the National Academies to carry out a critical review of their proposed plan for a National Center for War-Related Illnesses. Presumably, such a center would coordinate research related to several of the areas of focus in this report. DoD has also recently named several of its research institutions as centers for clinical and epidemiologic studies of war-related illnesses. Finally, a recent DoD Broad Agency Announcement invited proposals for research related to war-related illnesses (Commerce Business Daily, 1999).

STUDY PROCESS AND INFORMATION SOURCES

The study presented in this report was led by two principal investigators: an infectious disease specialist and a psychiatrist. To provide additional breadth of expertise to match the breadth of the charge to the study, a panel of expert advisors was convened. Members of the panel had expertise in the fields of medical record keeping, epidemiology, reproductive health, toxicology, infectious diseases and vaccines, psychology, psychiatry, chemical warfare agents, risk communication, biomedical ethics, and neurobiology.

The principal investigators and advisors (the study team) gathered information through several means. Four public workshops and a discussion meeting were held to collect relevant information. At the workshops, members of the military services, DOD, and representatives of other relevant agencies such as VA provided briefings and participated in discussions about ongoing and planned programs related to protecting the health of deployed forces. Outside (non-military) experts were also invited to provide relevant information from the civilian sector. The information provided in workshop presentations and discussions formed an important basis of this report. The dates and agendas from these workshops, including names and affiliations of speakers, are provided in Appendixes D and E, respectively.

The study team sought additional inputs from experts through commissioned papers. Focused questions related to various study topics were directed to 11 distinguished people who wrote background papers for the study team. The papers served as useful bases for the workshop discussions and study team considerations. These papers and their authors and affiliations are listed in Appen-

dix F. One paper in particular was integral to the evolution of the report. Chapter 3 draws much of its information from that paper, which is included as a signed contribution in Appendix A. Institute of Medicine staff gathered journal articles, DoD documents, and material from the World Wide Web and other sources to supplement information from the workshops and commissioned papers. Finally, Institute of Medicine staff gathered information and carried out a literature review to augment the information available to the study team on the topic of reintegration into the home environment.

THE FUTURE MILITARY

Joint Vision 2010 is a document prepared by the Joint Chiefs of Staff in 1996 to describe the nature of warfare envisioned in the near future (U.S. Department of Defense, 1996b). Revised operational concepts of dominant maneuver, precision engagement, focused logistics, and full-dimensional protection provide a framework for planning in the future. At the foundation of the vision are quality forces who are better trained and more highly skilled than they were in the past. Active and passive protection measures are anticipated to provide better protection against opponents at all echelons. At the same time, service members will use higher-technology equipment to carry out their missions. Forces will be increasingly dispersed and mobile, with less continuous support from a smaller logistics "footprint" (the size of the deployed presence). The document notes a first priority of recruiting and retaining dedicated high-quality people. For reserve components, less startup time between employment and deployment is anticipated, with the need for rapid integration into joint operations.

The implications of this vision for strategies to protect the health of deployed forces are several. The deployment of smaller, more mobile units means that each service member is more crucial to the success of the mission, but fewer medical resources are available to him or her. Preventive tools will be crucial for the prevention of disease and injury.

Accordingly, this report focuses on prevention measures for future deployments. Lessons learned from the past and from public health suggest that surveillance coupled with record keeping will be crucial. Medical surveillance permits the identification of problems and opportunities for intervention, and the associated record keeping permits additional benefit from retrospective analysis. Coupled with these, research and intervention efforts directed towards medically unexplained symptoms will provide important tools for the future military.